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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

February 1968 United States Employment Service Technical Report S-407

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Development of USES Aptitude Test Battery for Quality Control Worker

(can. and preserv.) 529.387

U.S. DEPARTMENT OF LABOR
MANPOWER ADMISTRATION

Technical Report on Development of USES Aptitude Test Battery

For . . . . .

Quality Control Worker (can. & preserv.) 529.387

S-407

(Developed in Cooperation with the
Oregon and Washington State Employment Service)

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February 1968

FOREWORD

The United States Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

Charles E. Odell

Charles E. Odell, Director
U. S. Employment Service

DEVELOPMENT OF USES APTITUDE TEST BATTERY

for

Quality Control Worker (can.& preserv.) 529.387-052

This report describes research undertaken for the development of General Aptitude Test Battery (GATB) norms for the occupation of Quality Control Worker (can. & preserv.) 529.387-052. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
N - Numerical Aptitude	95
P - Form Perception	110
F - Finger Dexterity	90

RESEARCH SUMMARY

Sample:

63 female workers employed as Quality Control Workers of several food canning and preserving plants in Oregon and Washington.

Criterion:

Supervisory ratings

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations, and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .45 ($P/2 < .0005$)

Effectiveness of Norms:

Only 65% of the nontest-selected workers used for this study were good workers. If the workers had been test selected with the above norms, 82% would have been good workers. 35% of the nontest-selected workers used

for this study were poor workers. If the workers had been test selected with the above norms, only 18% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	65%	82%
Poor Workers	35%	18%

SAMPLE DESCRIPTION

Size: N = 63

Occupational Status: Employed workers

Work Setting: Workers were employed at the following locations: Lamb-Weston, Inc., Weston, Oregon; Umatilla Canning Co., Milton-Freewater, Oregon; Smith Canning and Freezing Co., Pendleton, Oregon; Pendleton Frozen Foods Co., Pendleton, Oregon; Birdseye Div., General Foods Corp., Walla Walla, Washington.

Employer Selection Requirements:

Education: High school graduates preferred.

Previous Experience: None required.

Tests: No screening tests are used at four of the plants. The other administers a short numerical test with the accent on determining percentages and the correct placing of decimal points.

Other: Normal color discrimination; personal interview.

Principal Activities: The job duties for each worker are a combination of two or more of the tasks shown in the job description in the Appendix.

Minimum Experience: All workers in the sample had at least one month of job experience.

TABLE 2

Means (M), Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

	Mean	SD	Range	r
Age (years)	27.7	10.5	16-62	-.071
Education (years)	12.6	1.8	8-16	.409**
Experience (months)	29.8	45.5	1-180	.134

** Significant at .01 level

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B, were administered to 48 of the sample in 1964-1967. GATB, B-1002A scores were already available for 15 of the sample so were used to avoid retesting.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency made at approximately the same time as the test data were collected. Independent ratings were made by the workers' immediate supervisors on each work shift in each plant.

Rating Scale: The USES Descriptive Rating Scale, Form JP-21, was used. The scale (see Appendix) consists of nine items with five different alternatives for each item. The alternatives indicate the different degrees of job proficiency.

Reliability: The second supervisory rating at the plant supplying about half the sample was lost. By the time it was decided it could not be located, the rater did not believe he could make a valid rating for the temporary employees who had been gone for sometime. A second rating was obtained for all but 13. The correlation between the first and second rating for 50 of the final sample was .847. The final criterion consisted of the first rating for the entire sample.

Criterion Score Distribution: Possible Range: 9-45

Actual Range: 16-43

Mean: 30.2

Standard Deviation: 6.1

Criterion Dichotomy: The criterion distribution was dichotomized into low and high groups by placing 35% of the sample into the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers". The criterion critical score is 28.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were considered for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitude Q, which did not have a high correlation with the criterion, was considered for inclusion in the norms because the qualitative analysis indicated that the aptitude was important for job duties and the sample had a relatively high mean score for this aptitude. Aptitude F was considered for inclusion in the norms since Finger Dexterity was considered to be of critical importance for the job. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis

(Based on the job analysis, the aptitudes indicated appear to be important to the work performed.)

Aptitude	Rationale
G - Intelligence	Making independent judgments and understanding written instructions and formulas.
N - Numerical Aptitude	Counting; making calculations; applying arithmetic formulas to determine percentages, fractions, and correct placing of decimals.

P - Form Perception — Inspecting samples for noticeable differences; making minor adjustments to scales, thermometers, and other equipment.

Q - Clerical Perception — Coding samples; recording calculations; entering test results on various records and forms.

F - Finger Dexterity — Peeling samples of small vegetables; separating mixed samples; adjusting small measuring devices.

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB: N = 63

Aptitudes	Mean	SD	Range	r
G - Intelligence	111.3	14.7	80-144	.342**
V - Verbal Aptitude	110.0	16.1	76-137	.210
N - Numerical Aptitude	108.9	17.9	50-147	.398**
S - Spatial Aptitude	108.9	19.7	71-156	.048
P - Form Perception	121.0	20.6	67-171	.357**
Q - Clerical Perception	124.2	18.4	81-164	.223
K - Motor Coordination	115.2	14.6	82-159	.284*
F - Finger Dexterity	110.9	17.4	73-151	.116
M - Manual Dexterity	110.0	21.7	43-156	.118

* Significant at the .05 level
** Significant at the .01 level

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X		X		X	X		*	
Irrelevant									
Relatively High Mean					X	X	X		
Relatively Low Sigma	X						X		
Significant Correlation with Criterion	X		X		X	X	X		
Aptitudes to be Considered for Trial Norms	G		N		P	Q	K	F	

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of aptitudes G, N, P, Q, K, and F at trial cutting scores were able to differentiate between the 65% of the sample considered good workers and the 35% of the sample considered poor workers. Trial cutting scores at five point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores slightly higher than one standard deviation below the mean will eliminate about one-third of the sample. For four aptitude trial norms, minimum cutting scores slightly lower than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. The optimum differentiation for the occupation of Quality Control Worker 529.387-052 was provided by norms of N-95, P-110 and F-90. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .45 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms, N-95, P-110 and F-90

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	8	33	41
Poor Workers	15	7	22
Total	23	40	63

Phi Coefficient (ϕ) = .45 Chi Square (X^2) 12.6
Significance Level = $P/2 < .0005$

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into any of the existing 36 OAP's included in Section II of the Manual for the General Aptitude Test Battery. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.

A-P-P-E-N-D-I-X

11/56
SP-21

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score_____

RATING SCALE FOR_____
D. O. T. Title and Code

Directions: Please read the sheet "Suggestions to Raters" and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of worker (print)_____
(Last) (First)

Sex: Male_____ Female_____

Company Job Title:_____

How often do you see this worker in a work situation?

☐ See him at work all the time.

☐ See him at work several times a day.

☐ See him at work several times a week.

☐ Seldom see him in work situation.

How long have you worked with him?

☐ Under one month.

☐ One to two months.

☐ Three to five months.

☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.

☐ 2. Capable of low work output. Can perform at a slow pace.

☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.

☐ 4. Capable of high work output. Can perform at a fast pace.

☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

☐ 1. Very poor. Does work of unsatisfactory grade. Performance is inferior and almost never meets minimum quality standards.

☐ 2. Not too bad, but the grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.

☐ 3. Fair. The grade of his work is mediocre. Performance is acceptable but usually not superior in quality.

☐ 4. Good, but the grade of his work is not outstanding. Performance is usually superior in quality.

☐ 5. Very good. Does work of outstanding grade. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

☐ 1. Very inaccurate. Makes very many mistakes. Work needs constant checking.

☐ 2. Inaccurate. Makes frequent mistakes. Work needs more checking than is desirable.

☐ 3. Fairly accurate. Makes mistakes occasionally. Work needs only normal checking.

☐ 4. Accurate. Makes few mistakes. Work seldom needs checking.

☐ 5. Highly accurate. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials, and methods that have to do directly or indirectly with his work.)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by".

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Very low aptitude. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Low aptitude. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Moderate aptitude. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. High aptitude. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Very high aptitude. Does his job with great ease. Unusually well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

☐ 1. A very limited variety. Cannot perform different operations adequately.

☐ 2. A small variety. Can perform few different operations efficiently.

☐ 3. A moderate variety. Can perform some different operations with reasonable efficiency.

☐ 4. A large variety. Can perform several different operations efficiently.

☐ 5. An unusually large variety. Can do very many different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Very unresourceful. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Unresourceful. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Fairly resourceful. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Resourceful. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Very resourceful. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How often does he make practical suggestions for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Never. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Very seldom. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Once in a while. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Frequently. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Very often. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and <u>only</u> these factors, how satisfactory is his work? (Worker's "all-around" ability to do his job.)

☐ 1. Definitely unsatisfactory. Would be better off without him. Performance usually not acceptable.

☐ 2. Not completely satisfactory. Of limited value to the organization. Performance somewhat inferior.

☐ 3. Satisfactory. A fairly proficient worker. Performance generally acceptable.

☐ 4. Good. A valuable worker. Performance usually superior.

☐ 5. Outstanding. An unusually competent worker. Performance almost always top notch.

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FACT SHEET

Job Title: Quality Control Worker (can. & preserv.) 529.387-052

Job Summary: Makes a variety of tests of vegetables to determine the quality. Collects samples, measures, weighs, or counts out portions and follows formulas or written instruction to calculate moisture content, percentages of varieties in mixed vegetables, weight loss, enzyme inactivation, blanching adequacy, chlorine content of grader water, and enters results on proper control forms. Codes samples with code book using counts, percentages, and test results. Notifies supervisor or foreman of any test results, counts, or poor packaging that need corrective measures or attention.

Work Performed: Draws random sample of peas from graders with small sieve. Carries sample tray to work table. Peels 50 peas by cutting peal with thumb or finger nail and squeezing cotyledon from peel. Pours into brine solution and counts those that sink in brine. Records count. Inspects sample for presence of oil, weevil, and pod or weed pieces.

Prepares and makes peroxidase tests according to formula to determine if product is blanched adequately. Prepares and makes chemical tests for enzyme inactivation.

Checks weight of retail packages of vegetables by weighing packages selected at random from cases. Drops other random selected packages to concrete floor from shoulder height to test package strength. Determines ratio of each vegetable in mixed vegetable packages by separating and weighing each variety. Records results and notifies supervisor immediately if ratio is not correct. Takes random sample of frozen vegetable, inserts thermometer and reads and records temperature after specified time. Draws sample of each run of vegetables and carries to cold storage sample room. Places in section designated for that grower or customer. Draws sample for bacteriologist, being careful not to contaminate.

Takes random sample of peas from belt trough at start of dehydrating process, where they are 20% dehydrated, and at end of process. Counts out 100 peas from sample, weighs, and calculates weight loss percentage with slide rule. Records all calculations and times when samples are taken (dehydration process takes two hours and calculations are made on that basis). Takes random sample of peas during dehydration process. Counts out 50, peels, and makes sinker test in brine. Records percentage. Counts out 100 of sample and pours into stacked set of sizing sieves. Counts and records number on each sieve. Checks samples for color variance (matter of judgment).

Inspects 200 ounce sample of frozen dehydrated peas at tote bin for extraneous material and enters kind and amount of material on code sheet. Takes part of sample to laboratory. Weighs out nine ounces, pours into pan, adds 18 ounces of water, and brings to boil on electric burner. Simmers for seven minutes, pours into strainer, and cools with cold water. Drains sample for two minutes, weighs, and records reconstituted weight on code sheet. Calculates weight reduction of sample by formula and records results while sample is simmering.

Calculates number of peas in nine ounce sample by formula. Rounds to nearest 100 and records. Counts and calculates percentages of undehydrated, broken, and blemished peas in sample and those that vary from uniform color. Determines color score from chart. Codes samples of peas from code book, using counts, results of tests, and percentages. Notifies U.S. Department of Agriculture inspectors of lot codes, requests ticket numbers, and records them on code sheet.

Notifies supervisor or foreman of any test results, counts, or poor packaging that require attention or correction. Enters results of various tests, counts, and weights on code sheets, warehouse records or other quality control forms. Makes minor adjustments to scales and other equipment used. Washes beakers, test tubes, pans, and other equipment as necessary. Winds time clocks, changes letters in coding equipment, and inks equipment and pens.

Effectiveness of Norms: Only 65% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-407 norms, 82% would have been good workers. 35% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-407 norms only 18% would have been poor workers.

Applicability of S-407 Norms: The aptitude test battery is applicable to jobs which include a combination of two or more of the duties described above.

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